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# Program Evaluation of an Executive Functions Intervention at a Middle School Setting

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# PROGRAM EVALUATION OF AN EXECUTIVE FUNCTIONS INTERVENTION AT A MIDDLE SCHOOL SETTING

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Dissertation Approval

This is to certify that the thesis presented to us by Minu S. Poulose on the 7th day of May 2012, in partial fulfillment of the requirements for the degree of Doctor of Psychology, has been examined and is acceptable in both scholarship and literary quality.

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# Abstract

Executive functions play an important role in children's cognitive, academic and social functioning. The present study investigated the changes in executive functions in students who were enrolled in an academic support period everyday for forty-five minutes. Participants included twenty-six eighth-grade students eligible for Special Education and Related Services in a suburban middle school in New Jersey. The study used archival data consisting of items from the 44-item Executive Functions (EF) Rating Scale, a questionnaire that was completed by middle school special education teachers. To examine differences within groups, repeated measures analysis of variance (ANOVA) were conducted to examine teacher ratings and changes in grades. Although the study did not find a significant difference on EF Rating Scale obtained before, during and immediately after program implementation, of all the students' mean grades were all within the passing range for the first and second marking periods.

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# Chapter 1

## Introduction

A decade ago, our understanding of executive functions was remarkably limited, especially in school settings. Executive functions as applied in a school setting include the ability to maintain attention, control impulses, resist distraction, maintain effort, engage in mental planning and problem solving, maintain flexibility, manage time, set priorities, organize and execute tasks, and self-monitor (Maricle, Johnson & Avirett, 2010). Academic problems can persist despite adequate performance on psychometric measures of intelligence, having no identifiable learning disabilities, and no domain-specific processing deficits in areas such as perception memory, or language (Denckla, 1996). Cognitive deficits that may be related with executive dysfunction include poor impulse control, difficulties monitoring or regulating performance, planning and organizational problems, poor reasoning ability, difficulties generating and/or implementing strategies, perseveration and mental inflexibility, poor utilization of feedback and reduced working memory (Anderson, 2002). Good executive functions are necessary for productivity at the middle school level. The ability to self-regulate, monitor, correct, and plan are in high demand during the middle school years. With the increased executive demands of middle school, it is crucial to determine effective interventions during the period of adolescence. The author's purpose is to expand upon the existing knowledge about executive functions and interventions for executive functions difficulties at the middle school level.

**Statement of the Problem**

Executive functions are thought to play an important role in academic achievement during the middle school years and are activated in situations that require selective attention, extended mental effort, higher-order problem solving, increased control over information processing, and need for coordinating multiple processes simultaneously during academic tasks (Meltzer, 2007). Executive functions are essential to the real world as students learn to address their academic, social and emotional needs. As a consequence, poor executive functions can lead to inadequate academic production in the areas of reading, mathematics, and writing. In particular, children with executive function deficits have difficulty with planning, organizing, managing time and space, difficulty planning a project, and have difficulty comprehending how much time a project will take to complete (Meltzer, 2007). They struggle to tell a story (verbal or written format) and have trouble communicating details in an organized, sequential manner. Furthermore, children with executive deficits have difficulty with the mental strategies involved in memorization and with retrieving information from memory, trouble initiating activities or tasks, or in generating ideas independently and difficulty retaining information while doing something with the information; e.g., when solving math problems. As a result, children with deficits in executive functions may fail to adequately develop the abilities to interact productively and effectively with the environment (Marlowe, 2010). Because of these difficulties, children with executive function deficits need explicit instruction in planning, organizing, managing time and space, managing long term projects and tools in order to generate ideas independently and to achieve academic success. However, concrete ways to integrate teaching about executive

functions in the curriculum in the context of teaching reading, writing, and mathematics are necessary.

In the past decade there has been progress in developing curricula and training programs to promote executive functions and self-regulation. To date, most programs focused on developing self-regulation have fallen under the domain of social and emotional learning (SEL) programs (Greenberg, et al., 2003). These programs focus on improving a number of skills including self-control, emotional awareness, communication, social problem-solving skills and skills for making and maintaining friendships. Although there has been considerable interest in promoting self-regulation to improve behavior, there has been little attention regarding how executive functions are related to classroom learning and academic achievement. A pre-school intervention model, *Tools of the Mind* (Tools), based on Vygotsky's insights into executive functions and their development in early childhood has shown changes in both working memory and inhibitory control (Diamond, Barnett, Thomas, & Munro, 2007). Tools has been refined through twelve years of research but its use is limited to preschools and kindergarten students (Diamond et al. 2007). Curricula and training programs to promote and explicitly teach executive functions in a middle school setting are limited. A program that targets the development of executive functions at the middle school is the Executive Functions Skill-Building Program developed by Rush NeuroBehavioral Center (Bozeday, Gidaspow, & Smith 2011). This program strives to improve students' academic performances by improving their executive functions. Students are taught explicitly how to plan, to solve problems strategically, to self-regulate behavior, to make decisions, to monitor their attention, evaluate their performance and manage their time.

The comprehensive scope and sequence allows teachers to help students build on previously taught skills (Bozeday et al., 2011).

**Purpose of the Study**

The purpose of the present study is to examine archival data to evaluate if eighth grade students who participated in an academic support program show increases in effective executive functions, using the Executive Functions Skill-Building Program developed by Rush NeuroBehavioral Center (Bozeday et al., 2011). The academic support program provides eighth grade students with the opportunity to learn how to self-regulate their own learning processes. Students attended the academic support program for forty-five minutes daily for an entire school year. The present study will examine changes in executive functions in these eighth grade students with a particular focus on areas of executive processes related reading, writing, math and study skills. Teachers completed an "Executive Functions Rating Scale" (Appendix) three times during the school year to monitor progress. Students' grades from the first marking period to the second marking period were examined in all academic courses. Consistent with research studies that have linked self-regulatory executive function capacities to academic achievement, it is proposed that the academic support program increased knowledge of and use of executive functions in these students identified as meeting the classification for special education services and who also had an Individualized Education Plan (IEP).

# Chapter 2

# Literature Review

## Definition of Executive Functions

A wide array of definitions appears in the literature on executive functions. Currently, a universally accepted definition of executive functions does not exist. Definitions of executive functions have changed over time but it is commonly believed that executive function is a psychological construct that can be best described as a number of separate yet interrelated control processes that are activated during novel activities in which new solutions are needed or are activated when initial learning takes place (Anderson, 2002). Original descriptions of executive functions focused on the coordination of basic cognitive processes during goal-oriented problem solving and did not have any direct application to the classroom (Flavell, Friedrichs, & Hoyt, 1970). Self-regulation and metacognition play an important role in the learning process by helping students have a sense of control over their learning experiences and including planning, monitoring, and evaluation of their own work. Brown and Campione's (1983) definition differentiated executive functions from self-regulation and extended it into the classroom setting in their work on metacognition. Denckla (1989) was one of the first researchers to describe executive functions as a broad term that encompasses many higher order skills necessary for independent, goal-directed behavior, including holding and manipulating information in working memory, and planning/sequencing multistep tasks. Executive functions are a "set of domain-general control processes that involve inhibition and delay of responding for the goal of organization and integration of cognitive and output processes over time" (Denckla, 1996, p. 265).

A different perspective on executive functions was offered by Lezak (1995) through her reviews of neuropsychological assessments. She emphasized the social importance of executive functions, noting the fact that it is essential for socially independent behavior. She identified four critical components of executive functions necessary for successful adaptive self-direction: volition (including self-awareness and self-monitoring), planning, purposive action, and effective performance. She proposes that while each of these domains comprises a distinct set of behaviors; however, it is rare for a person to exhibit impairments in only one executive domain. Lezak's (1995) view highlighted the role of motivation and emotion in executive functions. Her views incorporated the importance of considering social behavior because this interplays with social and emotional regulation during the school day. Other definitions of executive functions emphasize the multi-dimensional and goal directed nature of the construct. Executive functions are often referred to as an "umbrella term" (Anderson, 2002, p.71) that incorporates a collection of inter-related processes responsible for purposeful, goal directed behavior (Gioia, Isquith, & Guy, 2001). Included in this umbrella construct are mental constructs such as planning, higher-order organizational strategies, initiation, inhibition, working memory, goal selection and monitoring, self-evaluation and self-correction (Anderson, 2002). Executive functions are believed to be involved in multiple mental functions such as decision making, planning, inhibition, sequencing, development of plans of action, and motor outputs (Reynolds & Horton, 2008). Processes that constitute executive functions could be dichotomized as "cool" or "hot" executive processes (Zelazo, Qu, & Muller, 2004). "Cool" executive processes are considered purely cognitive, and are tapped into during abstract tasks, problems while "hot"

executive processes refer to affective aspects of executive functions and are required when a situation is meaningful and involves regulation of affect and motivation. According to this model, information is processed hierarchically and with relatively quick evaluative reactions. However, children and adolescents may be less reflective than adults.

In education, executive functions play a role in self-regulated learning, the process by which learners plan and then strategically guide their behavior toward the achievement of learning goals (Meltzer & Krishnan, 2007; Zimmerman, 1989). Academic success is linked with students' mastery of several key executive functions such as goal setting, planning, prioritizing, organizing, shifting flexibly, holding/ manipulating information in working memory and self-monitoring (Meltzer, 2010). Executive functions are difficult to define precisely because they are thought to include multiple mental functions. Common features include decision making, planning, inhibition, motor outputs, metacognition, self-monitoring and goal setting. The common features that exist in the sample of definitions and conceptualizations of executive functions may be useful in understanding the meaning and nature of this concept. Despite the lack of clear and specific definition, the role of executive functions within the classroom has become critical for academic and social success for students at all levels.

**Models of Executive Functions**

Executive functions are multidimensional and there exists a variety of models that provide varying viewpoints relative to its basis processes (Banich, 2009). The lack of consensus in the definition of the executive functions has led to competing models and

theories. Models of executive functions include those by Anderson (2002), Barkley (2001), Brown (2005) and McCloskey, Van Divner, & Perkins, 2008).

**Anderson.** The executive control system (Anderson, 2002) is largely influenced by factor analytic and developmental studies. This model conceptualizes executive functions as an overall control system which composed of four distinct domains: attentional control, cognitive flexibility, goal setting, and information processing (Anderson, 2002). The attentional control domain includes the capacity to attend selectively and the ability to focus attention for a prolonged period. Impulse control, the capacity to delay gratification is an integral part of this domain. Cognitive flexibility includes the ability to shift between response sets, learn from mistakes, divide attention, devise strategies and process multiple sources of information simultaneously. Goal setting includes the capacity to start an activity and devise a plan to complete the activity. The fourth domain, information processing is composed of fluency, efficiency and speed of output.

**Barkely**. Barkely's (2001) model breaks executive functions down into four different areas: nonverbal working memory, internalization of speech (verbal working memory), self-regulation of affect/motivation/arousal and reconstitution (fluency, flexibility and generativity). This model emphasizes self-regulation and inhibition, with self-control being the main purpose. Barkely (2001) suggested that executive dysfunction rather than attention is the core deficit in Attention Deficit Hyperactivity Disorder.

**Brown.** Brown's (2005) model of executive functions incorporates six different clusters. The six clusters are: (1) organizing, prioritizing and activating for tasks, (2)

focusing, sustaining and shifting attention to task, (3) regulating alertness, sustaining effort and processing speed, (4) managing frustration and modulating emotions (5) utilizing working memory and accessing recall and (6) monitoring and self-regulating action.

**McCloskey, Van Divner, and Perkins.** Finally, McCloskey and colleagues present a holarchical model of executive function (McCloskey, Van Divner, & Perkins, 2008). According to this model, executive functions comprise many different capacities that operate on numerous tiers across independent developmental lines. These tiers are: (a) self-activation, (b) self-regulation, (c) self-realization and self-determination, (d) self-generation, and (e) trans-self-integration. At the lowest tier, self-activation, a unitary construct has to do with how executive capacities wake up from sleep. The second tier, labeled self-regulation refers to a set of processes that cue the use of other mental capacities to direct and control perceptions, thoughts, actions, and emotions. At the second tier, there are a total of twenty-three self-regulation executive functions that include perceive, sustain, organize, manipulate, retrieve, monitor, and others. These twenty-three self-regulation capacities serve to mobilize and direct other mental processes to act flexibly and successfully toward the accomplishment of a task when responding to new demands or situations. The third tier, labeled self-realization and self-determination represent increasingly more abstract conceptualizations of executive functions. Self-realization refers to self-awareness and self-analysis. Self-determination executive functions cue the use of other cognitive processes to visualize the future and to formulate plans for goal-directed behavior. At the next higher tier, self-generation executive functions provide the cues to direct the generation of a philosophy of life that

serves as guidance in the realization of intentional behavior. At the highest tier, trans-self-integration executive functions assume a spiritual quality. McCloskey et al. (2008) postulated that progression through these levels can occur without attaining mastery of lower levels and that there is variability in performance because of the dissociable nature of executive control.

Anderson's model (2002) emphasized attentional control, fluency, cognitive flexibility and goal setting while Barkley's (2001) model was developed through a common process because each executive function is a form of covert behavior to the self. Barkley (2001) highlighted verbal and nonverbal working memory as the core components of his model. Brown's executive functions model (2005) incorporates various domains of attention, working memory, self-monitoring and self-regulation. The multidimensional, holiarchial model by McCloskey et al. (2008) postulated that development at one level does not need to be mastered or completed before higher levels are engaged. Furthermore, the model of McCloskey et al.'s model (2008) expands beyond the academic setting and is applicable to people of all ages. The models of executive functions have evolved over time, similar to the definitions of executive functions. The various models of executive functions cover a wide domain of skills. Nonetheless, common across most of them is the idea that executive function is a process used to guide behavior to a goal, to modulate attention, to inhibit as necessary, and to plan ahead for the future.

## Developmental Neuroanatomy of Executive Processes

**Brain Structures and Executive Functions.** Executive functions have been associated with frontal lobe functioning, with Luria (1966) being the first to attribute the

functions of the frontal lobes to executive functions. Anatomically, the frontal lobes are located toward the front of the head and above the sylvian fissure (Stuss & Benson, 1986). The frontal lobes contain the most complex forms of reflex activity organized hierarchically into a series of levels (Luria, 1966). Twenty years after Luria's attribution, conceptualization of executive function by Stuss and Benson (1986) described activities related to executive function were attributed to the frontal lobes that became active in nonroutine, novel situations that require new solutions. The anterior regions of the brain are thought to mediate executive functions because deficits in executive skills often follow damage to the prefrontal cortex (Stuss & Benson, 1986). The prefrontal cortex (the foremost area of the frontal lobes) is likely to play an important role in top-down influences on brain regions that are important for many complex emotional and cognitive functions (Davidson, 1999). The left prefrontal cortex and amygdala appear activated during affective states and may be related to goal-directed behaviors (Davidson, 1999). Damage to the left frontal lobe appears to affect encoding and damage to the right frontal lobe appears to affect retrieval process such as monitoring of output (Stuss & Alexander, 2000). However, even within the frontal lobes, there are layers of complexity, and a more detailed anatomical specification of the parts is essential (Alexander & Stuss, 2000). The neural systems supporting executive functions are multifaceted and inter-related, with the prefrontal cortex dependent on efferent and afferent connections with nearly all other brain areas including the brain stem, occipital, temporal, and parietal lobes as well as limbic and subcortical regions (Stuss & Benson, 1984). As a result of this complex network, executive dysfunction is not always associated solely with the prefrontal cortex. Executive functions have been associated with the frontal lobe

functioning, but impairments in other brain areas may also impact executive functions. Intact executive functions require the adequate performance of the prefrontal cortex and other parts of the brain.

**Development of Executive Functions.** Executive functions develop throughout childhood and adolescence and play a vital role in a child's cognitive function, behavior, emotional control and social interaction (Anderson, 2002). A child's developmental context must be considered when assessing executive function. The emergence of executive functions in childhood does not appear to be linear nor is it a gradual progression, but rather it correlates with age-dependent growth spurts of the frontal lobes (Maricle, Johnson & Avirett, 2010). Luria (1966) postulated that higher cortical functions such as executive functions required both the interaction of normal neurological development and specific environmental stimuli of a cultural, historical, and social nature in order to develop. The higher cortical functioning such as language, intention and memory would be the result of appropriate interaction of neurological development and with appropriate environmental stimuli. Luria (1966) proposed five stages of development. The first stage begins in the first year of life and involves the development of the brain stem structures such as the reticular activating system. The second stage involves the activation of the primary sensory areas of vision, hearing and tactile perception. It also includes the activation of the primary motor areas for gross motor movement in the second year of life. The third stage occurs at the time when the child enters preschool. The child's mind recognizes and reproduces various symbolic materials and is able to replicate various physical movements. The fourth stage begins as the child enters first or second grade. At this time, the tertiary areas of the parietal lobes, where

the temporal, parietal, and occipital lobes join, are activated. At this stage, the child begins to make sense of the sensory input and environmental stimulation which is particularly important for the development of complex mental abilities. The final stage becomes activated from age eight through adolescence and beyond, involving the frontal region and the development of complex mental abilities. The child's neuropsychological development and environmental stimulation are important for the development of higher level mental abilities such as executive functions, as described by Luria's (1966) theory. A child's developmental profiles and trajectories vary, depending on the executive skill at the time of assessment. Components of executive functions such as working memory, self-monitoring and reasoning need to be understood in a developmental context; otherwise they may be deemed as deficits.

**Developmental Changes in Adolescence.** Recent research has begun to reveal the nature and development of the adolescent brain in relation to executive functions. Most areas of the brain undergo major changes during adolescence. There is a steady increase in white matter in certain brain regions during childhood and adolescence. These changes are primarily in the frontal lobes and parietal lobes, which double or triple in size during adolescence (Jensen, 2008). A study using Magnetic Resonance Imaging (MRI) showed higher volume of white matter in the frontal cortex and parietal cortex in a group of children whose average age was 14 than in a group of children whose average age was 9 years (Sowell et al., 1999). This was followed by a decline during post-adolescence. The increase in white mater seems to be linear across brain areas but the change in grey matter appears to follow a non-linear pattern. Grey matter reflects neuronal density and the number of connections between neurons follows an inverted-U

shape over development, peaking at different ages depending on the regions. (Sowell et al., 1999). Gifedd et al., (1999) performed a MRI study on 145 healthy boys and girls from about 4 to 22 years. This study uncovered that the volume of grey matter in the frontal lobe increased during pre-adolescence with a peak occurring at approximately 12 years for males and 11 years for females. LaBerge' s (1995) work with neuroimaging methods has shown increased firing in the prefrontal and posterior parietal lobes and in the thalamus and anterior cingulate when a person is working hard to pay attention. Paying attention requires that students orient, engage, and maintain each appropriate neural network, and in addition exclude or suppress external and internal distraction (Jenson, 2008). Among brain pathways, the frontotemporal pathways are the last to develop (Reynolds & Horton, 2008). However, given the differences in maturation of executive functions, many children in the middle school may struggle to negotiate tasks that require invoking higher level executive processes. Because many areas of the brain are still developing when children are in middle school, it is important to teach children skills related to executive functions-related skills that they can utilize as they continue their academic careers.

**Cultural Differences**

There are cultural differences in executive function processes, even from a young age (Sabbagh, Xu, Carlson, Moses, & Lee, 2006). Sabbagh et al. (2006) found differences on measures of executive function when Chinese and United States (U.S.) preschoolers were compared to each other. The Chinese preschoolers performed significantly better than U. S. preschoolers on response inhibition, working memory, and general executive tasks. Sociocultural factors such as differential emphasis on the

importance of school in general, or of self-regulation specifically, in Chinese and U.S. classrooms may contribute to these differences (Stevenson & Stigler, 1992). Other studies have emphasized the role of experience in shaping the cognitive components of executive function. Young children of low socioeconomic status perform below children of middle class status on a range of cognitive and achievement tasks (Noble, Norman, & Farah, 2005). Noble et al. (2005) found that the presence of both parents in the home, parental stress and depression may also affect the development of cognitive and executive functions. Factors such as socioeconomic status, cultural differences in child rearing, and sociocultural behaviors play a role in the development of executive functions; this is in addition to parental stress and psychopathology.

**Executive Dysfunction**

Executive dysfunction is not a unitary disorder (Gioia et al., 2001). It is characterized by a variety of presentations and deficits in one or more areas of executive functions such as poor impulse control, difficulties monitoring or regulating performance, planning and organizational problems, poor reasoning ability, difficulties generating and/or implementing strategies, perseveration and mental inflexibility and reduced working memory (Anderson, 2002). Children who have difficulties accessing, organizing, and coordinating multiple mental activities at the same time in academic areas are characterized as actively inefficient learners (Swanson, 1989, Meltzer & Krishnan, 2007). As a result, these students are described as being inefficient because they struggle to use self-regulatory strategies such as checking, monitoring, and revising their work (Meltzer & Krishnan, 2007). By recognizing that executive functions have multiple aspects has practical implications in the classroom and allows educators to

devise more useful, differentiated diagnosis and interventions (Fischer & Daley, 2007). The challenge is in not identifying the executive dysfunction but determining the nature of the impairment because this determination will greatly influence intervention and treatment plans (Anderson, 2002). Fischer & Daley (2007) warn that statements such as deficits in executive function are less useful than teaching-targeted skills such as attention and planning. If students who are identified with executive dysfunction are not assisted through intervention, they may continue to struggle both within the academic and the social domain.

Executive impairments have been reported in a number of disorders such as attention deficit hyperactivity disorder (Grodzinksy & Diamond, 1992), autism (Bishop, 1993), and head injury (Garth, Anderson, & Wrennal, 1997). Currently, there is minimal research regarding patterns of performance on executive function tasks in various clinical groups (Maricle et al., 2010). Executive dysfunction has also been associated with children with learning disabilities who tend to have difficulties with self-regulation, problem solving, cognitive flexibility, and organization (Meltzer & Krishnan, 2007). Children who struggle with school skills often meet the criteria for attention deficit hyperactivity Disorder (ADHD) of one type or another and even seem to do poorly on tasks that required executive functions that are assessed with words (Denckla, 2007). Students with ADHD often display executive function deficits that poorly impact their strategic planning, goal setting and persistence, and as a result can be damaging to academic success (Johnson & Reed, 2011). Douglas (2005) postulated that executive functions are the root of the self-regulatory problems for children with ADHD. These children who are re-evaluated in the middle and high school often show deficits in their

executive abilities in both verbal learning tasks and on visual-spatial tasks (Denckla, 2007). Children in the middle school with executive functioning deficits are often labeled as being lazy, unmotivated, and irresponsible rather than being recognized with difficulties in neurodevelopment (Denckla, 2007). If children with executive dysfunction are not identified, they may continue to be labeled as being unmotivated and lazy when it comes to academic achievement.

**Middle School Setting**

Executive functions as applied in a school setting include the ability to maintain attention, control impulses, resist distraction, maintain effort, engage in mental planning and problem solving, maintain flexibility, manage time, set priorities, organize and execute tasks, and self-monitor (Maricle et al., 2010). Middle school and high school students who are referred for an assessment of executive function processes are those who are struggling with the demands for independence, speed, and integration that the curriculum at higher grades require. Many of these students have been successful in the elementary school where the focus is on developing isolated skills (e.g., decoding, spelling, math facts) and tend to struggle when they are required to integrate various skills such as reading comprehension, summarizing, and essay writing (Meltzer & Krishnan, 2007). Middle school students' schedules become more demanding and their schoolwork increases in complexity. Executive function skills are found to be central to many educational domain including reading, writing, mathematics, and other academic subjects. Problems with executive functions within the school setting may be apparent as failing to turn in homework despite having it completed it; an inability to initiate and carry out long-term projects; difficulty using mental strategies for memorization and

retrieval; trouble initiating tasks, generating ideas independently, and analyzing task requirements; or difficulty regulating impulses or emotion (Maricle et al., 2010). Moreover, students with learning disabilities often struggle with academic tasks that involve written output, summarizing, taking notes, or reading complex tests for meaning (Meltzer, 2004). In addition, they may have difficulty initiating work, prioritizing, selecting appropriate goals, shifting strategies, and self-monitoring. These difficulties impact the areas of reading, writing and math as well as organization, note taking, test taking and study skills.

**Reading Comprehension.** Reading problems can result from, or be intensified by ineffective or inconsistent use, of the executive functions capacities that direct the reading process, specifically poor sight word recognition, poor word decoding, poor reading fluency, and/or poor comprehension (McCloskey et al., 2008). Furthermore, executive function self-regulation cues used in reading production include sight word recognition, word decoding cues, reading rate cues and reading comprehension cues (McCloskey et al., 2008). Students with learning disabilities often struggle with the executive function process that impact their reading skills. In order to comprehend what is read, students need to draw from prior knowledge, shift flexibly from retrieving and interpreting previous knowledge to while attending to and interpreting print, and integrate previous information with new content (Meltzer & Krishnan, 2007). In addition, the role of working memory plays a role in reading comprehension due to the need to hold onto text read in short-term memory while attempting to extract meaning at the individual sentence level and paragraph level (Swanson, 1999). Baddeley (1992) posited the theory that working memory is supported by two systems which are necessary for reading

comprehension: the phonological loop and the central executive. The phonological loop or articulatory loop is described as a temporary storage system for brief maintenance of verbal information, and the central executive oversees active manipulation of information in immediate memory and retrieval of information from long term memory. Executive function processes such as the role of working memory and self-regulation cues are critical to reading fluency, decoding and comprehension.

**Written Expression.** Written expression involves various executive function processes (Meltzer & Krishnan, 2007) and is the academic skill area most visibly impacted by "executive function difficulties due to the physical form of the final product" (McCloskey et al., 2008, p. 153). The ability to think flexibly, plan, organize, prioritize, and revise are required when producing written work (Meltzer & Krishnan, 2007). Students with learning disabilities often struggle with spatial organization on a page, the using correct grammar at the sentence level, the organization of their thoughts and following a format (Graham, Harris & Olinghouse, 2007). Furthermore, poor text formation, text production speed, text generation, and/or text editing can result from, or be intensified by ineffective or inconsistent use of the executive functions capacities that direct the writing process (McCloskey et al., 2008). Written expression may cause students to become frustrated if they are not taught appropriate strategies, techniques and ways to organize their thoughts prior to, during and after the writing process.

**Mathematics.** Baddeley's model (1996) can be used to capture proficiency in working memory as it applies to word problem-solving and age-related performance in mathematics. Baddeley (1996) described working memory as a limited-capacity central executive system that interacts with a set of two passive storage systems used for

temporary storage of different classes of information: the speech-based phonological loop and the visual sketch pad. The visual sketch pad is responsible for the storage of visual–spatial information over brief periods and plays a key role in the generation and manipulation of mental images. Both storage systems are in direct contact with the central executive system.

Working memory capacity constrains mental arithmetic and mathematics performance. St Clair-Thompson and Gathercole (2006) found that both working memory and inhibition uniquely predicted curriculum attainment in mathematics and English. Working memory and inhibition support general academic learning rather than the acquisition of skills and knowledge in specific domains. The central executive is a core component of learning difficulties in mathematics, but it is argued that the phonological loop and visual-spatial sketch pad may contribute to more specific math cognition deficits, dependent on what aspects of mathematical skill are being assessed (Geary, Hoard, Bryd-Craven, Nugent, & Numptee, 2007). Geary et al., (2007) found that children with a math disability scored one standard deviation below their low achieving peers on measures of each working memory systems and showed a deficit of about the same magnitude on the speed of processing measures. In the same way, curriculum based mathematics involves competence in skills such as counting, mental arithmetic, measurement abilities, and space abilities, all of which may require working memory resources.

**Independent Studying.** As students advance to the higher grades, tasks such as independent studying, long-term projects and homework are highly dependent on executive function processes. Students with learning disabilities often struggle with tasks

that are highly dependent on executive function processes that require them to plan ahead, predict outcomes, and set long-term goals. Independent projects are especially challenging for students with weak executive functions. In order to complete projects successfully, students need organize, to manage their time, to sequence information, and acquire materials and information needed to complete tasks, in addition to remembering to submit them in a timely manner (Meltzer & Krishnan, 2007).

**Note-Taking.** Note-taking skills become increasingly important at the middle school level and are valuable skills. However, very little research has been conducted on the problems that students with learning disabilities encounter when recording notes during lectures. Suritsky (1992) interviewed thirty-one students with learning disabilities to see how they approach note-taking in college lectures. The top four most common problems encountered by college students in this study were: writing fast enough to keep up with the lecturer, being able to pay attention, making sense out of notes after the lecture and deciding what important lecture information to record.

Seventh grade students with learning disabilities obtained much lower scores than their peers on note-taking traits in Social Studies (Okolo et al., 2008). Their scores were substantially lower than the standard deviations obtained by their nondisabled peers across the four primary traits for note taking: content coverage, reduction of the information into essential phrases and paragraphs, ratings of effectiveness of their notes for studying and learning and the organization of their notes (Okolo et al., 2008). Students with disabilities in this study produced notes that contained somewhat random and unorganized facts or notes copied nearly verbatim from the passage.

**Organizational Skills.** Organizational skills are essential to school success especially during the secondary school years due to tasks that require planning, prioritizing, and organization. An increasing emphasis is placed on long-term projects, independent work, book reports and group work at the secondary level. Organizational skills allow students to manage their time and materials productively and take charge of their own academic learning (Anderson, Munk, Young, Conley, & Caldarella, 2008). Students with difficulties in organizational skills tend to forget to bring necessary items to class, stuff their assignments into wrong folders, misplace assignments, forget assignments at home and may be penalized for not turning things in time. As a result, their grades are impacted especially in secondary school when teacher expectations are greater and supervision of students tends to be more limited than during elementary years (Anderson et al., 2008). Students with organizational difficulties need explicit instruction to learn organizational skills required for academic success.

## Interventions for Enhancing Executive Functions

Interventions for enhancing executive function processes in the classroom should include the following main points (Meltzer, Pollica, & Barzillai, 2007, p. 168):

- Strategy instruction should be directly linked with the curriculum.
- Metacognitive strategies should be taught explicitly.
- Strategies should be taught in a structured, systematic way, using scaffolding and modeling and providing time for practice.
- Students' motivation and self-understanding should be addressed to ensure generalized use of strategies.

Interventions for developing students' executive functions is from external to internal by intervening at the level of the environment or by intervening at the level of the person. Dawson & Guare (2004) describe ways to change the environment by altering the physical environment, changing the expectations of the task, and changing the way cues are provided to prompt the student. Intervention can be focused on the person by changing the child's capacity for using executive functions.

**Environmentally Focused Interventions.** Interventions at the level of the environment rely on adults to modify the environment by providing support, control, and reinforcement. Environmental alterations might include increasing the structure and routine of the classroom, clarifying classroom expectations, teaching and practicing expected behaviors, providing clear directions with positive feedback for performance, altering tasks, providing explicit instruction for each task component, and teaching the use of strategies such as calendars, graphic organizers, visual schedules, or cueing techniques (Dawson & Guare, 2004). Altering the task can include making the task shorter, making the steps more explicit, making the task closed-ended, building in variety or choice and providing scoring rubrics. Examples of cues to prompt behavior include verbal prompts or reminders, visual cues, schedules, lists, and audio taped cues. Teachers who post homework assignments, test scores and the results of other assessments online where parents and students can access them increase home-school communication and as a result, make it easier for parents to assist with executive function cueing as needed (McCloskey et al., 2008). Students who have organizational skills will benefit especially from increased home-school communication between parents, guardians and educators. Environmental adjustments that are conducted at home typically center on homework and

might include identifying a place and time to complete homework, providing assistance from parent to structure and monitor homework, reviewing homework assignments recorded in the agenda and completing assignments under parental supervision (Maricle et al., 2010).

**Person-focused Interventions.** Interventions at the individual level focus on teaching specific executive functions and motivating the child to use them effectively (Maricle et al., 2010). Person-focused intervention often takes the form of direct retraining of cognitive abilities. Most children fail to use executive skills due to the lack of skills. Mahone and Slomine (2007) emphasize the fact that teaching executive skills must be coached, rehearsed, and practiced, preferably in the environment in which they need to be performed. Parents and teachers must first teach the skills, provide external support and monitor the skill development and provide time for the skill to be part of the child's routine (Maricle et al., 2010).

In school settings, cognitive behavioral strategies tend to be the most effective, and direct retraining (Maricle et al., 2010). Self-instructional training is a promising, person-focused intervention that is applicable to executive functions. Children are taught to self-regulate their behavior through the use of self-talk. The basis of this approach stems from the work of Vygotsky and Luria (Sohlberg & Mateer, 2001). Important components of direct retraining include writing a task analysis that breaks the task into sequential steps, creating explicit instructions for each step, and providing time to practice each step and using reinforcement and motivation to succeed (Sohlberg & Mateer, 2001).

**Reading Intervention.** Executive functions enable readers to monitor what they read to ensure comprehension; these include planning, directing, selecting, and orchestrating the various cognitive structures (Gaskins, Satlow & Pressley, 2007). Gaskins et al. (2007) describe seven principles of executive control of reading comprehension. The first executive principle of reading comprehension that should be explicitly taught is that reading must make sense. The second principle of executive control expresses the importance of planning how the comprehension goal will be attained. The importance of prioritizing time and effort for reading tasks is the third principle. The fourth and fifth principles include accessing background information and self-checking comprehension before and during reading process. The reader should be willing to change his or her mindset in regard to strategies; therefore, interpretation is described as the sixth principle of executive control of reading comprehension. The final principle is the need to self-assess or evaluate whether or not one's comprehension goal was achieved or to determine what action that needs be taken to correct in order to correct the situation.

**Writing Intervention.** Students often struggle to break down the writing process into manageable steps and would benefit from strategies that help them analyze, structure, and remember the steps involved (Meltzer, 2010). Certain strategies that help students plan, organize, prioritize, and check their work; for example, the BOTEC strategy from Essay Express (Research Institute for Learning Development & Fable Vision, 2005) helps students with the writing process. BOTEC is broken down into Brainstorming, Organizing, generating a Topic sentence, providing supportive Evidence, and generating a Conclusion. A writing strategy for planning and drafting compositions

include the POW: Pick my ideas; Organize my notes; and Write and say more (Graham, Harris & Olinghouse, 2007). To help students organize a persuasive essay is the TREE strategy which reminds students to Tell what you believe, give three more Reasons to support your belief, End it, and Examine your paper (Graham et al., 2007). A variety of writing strategies can be utilized to assist students to pick a topic, plan, generate ideas, and develop their thoughts into written format.

**Mathematics Intervention.** Math strategies that address executive functions include memory strategies, organization strategies, shifting strategies and checking strategies (Roditi & Steinberg, 2007). Memory strategies include teaching acronyms, using visual strategies, and a hands-on methods to help students with executive functions difficulties. Organizational strategies include using lists, charts, and tables. An example of an organizational strategy include the application of Triple Note Taking; three-column note taking is useful for organizing strategies in mathematics (Research Institute for Learning Development & Fable Vision, 2005). The three-column note taking teaches students how to take create a template, use their own words into the definitions and use the template as a study guide. The three-column note taking in mathematics is used in the following way: the first column includes a term, equation or concept; the second column includes the meaning of the term in the student's own words, and the third column includes writing or drawing a strategy that will help the student remember the information.

**Problem Solving Using Language Mediation.** Verbal mediation may be one strategy for children with higher level language disorders that result in executive dysfunction and for children with executive dysfunction who have strong language skills

(Marlowe, 2010). Bernstein (1996) emphasized verbal learning as a learning strategy for children who have difficulty with initiation, transitions, and integration. The specific steps include (a) identify the problem, (b) identify the requisite step, and (c) highlight the steps by labeling, using fingers to visually indicate sequence (Bernstein, 1996).

**Study Skills Intervention.** Students who use study skills effectively have greater academic success. Students with learning disabilities and attentional difficulties need systematic instruction in study strategies that assist them to organize their materials when they study, to utilize various strategies, analyze questions on tests and check their answers (Meltzer, Pollica, & Barzillai, 2007). Study skills are expected to be a part of students' homework routines or test preparations; however, these skills are rarely taught explicitly to students (Gettinger & Seibert, 2002). The effects of the SQ4R (Survey, Question, Read, Write, Recite) method on study skills and academic achievement were examined with high school students with specific learning disabilities (Hayden & McLaughlin, 1987). The use of SQ4R resulted in improved grade-point averages and achievement test scores in learning disabled students. Meyer & Kelley (2011) examined the effectiveness of parental and self-monitoring for reducing homework problems, for improving homework completion and for test preparation in middle school students with ADHD and found that self-monitoring was as effective as parental-monitoring in reducing problems with homework completion.

**Homework Intervention.** Many students struggle to complete homework due to various reasons. As students mature, they tend to reject the efforts of adults who attempt to assist them with homework, even though they may need it. The problems of those with disabilities are directly linked to skills associated with homework such as

listening, memory and organizational deficits (Hughes, Ruhl, Schumaker, Deshler, 2002). As a result, students might forget to take home appropriate materials for completing assignments and not know what has been assigned or not know how to complete the assignment. An assignment strategy, called the PROJECT Strategy, was created to teach students the steps involved in assignment completion (Hughes et al., 2002). The first letters of the major steps form the mnemonic device "PROJECT." The seven steps consist of the following: *Prepare Your Forms, Record and Ask, Organize, Jump to it, Engage in the work, Check your work and Turn in your work* (Hughes et al., 2002). Students fill in numbers corresponding to the days of the current and subsequent months on two monthly calendars for the first step of the assignment completion strategy, *Prepare Your Forms.* The second step of the strategy, *Record and Ask*, students independently and accurately records the assignment given by a teacher. The third step of the strategy, *Organize*, is primarily used at the end of the day. There are four sub steps in this step to form the mnemonic device "BEST." Initially, the student *Breaks the Assignment into Parts* followed by next step *Estimate the Number of Study Sessions* required to complete the assignment. Next, the student *Schedules the Sessions* by writing the days and times to complete the assignment in the weekly study schedule. Finally, the student *Takes the Materials Home* by taking all materials needed for each assignment in his or her backpack to bring home. The fourth, fifth and sixth steps of the assignment completion strategy are used when the student is scheduled to work on the assignment. The fourth step, *Jump to It*, is used to overcome task avoidance and to begin the assignments. If the student notices any problems or difficulty while completing the assignments, the fifth step involves getting help from parents or a classmate from that

class (*Engage in the Work).* When the work is completed, the student reviews the quality of work (*Check Your Work).* The final step, *Turn in Your Work*, consists of putting away the assignment in the assignment folder after completion and turns it in the next day in school.

**Organizational Skills Intervention.** Organizational difficulties are challenging for students with learning and behavior disabilities. Students need explicit systems and strategies to learn organization of materials, such as color-coding strategies to organize their notebooks, binders, and assignments books (Meltzer, Pollica, & Barzillai, 2007). Explicit instruction in organizational strategies is essential for students with learning disabilities and/or attentional difficulties (Meltzer & Krishnan, 2007). Time allotted on a weekly basis for organization of materials is critical to maintain their materials. Anderson et al. (2008) implemented an organizational skills instruction in a junior high school life skills class for students at risk for developing emotional and behavioral problems. The intervention comprised four phases. The first phase comprised teaching students how to use a self-monitoring form. The second phase involved utilizing the self-monitoring form in their most difficult class. The third phase required obtaining teacher verification and the fourth phase included participating in goal setting and behavior contracting. In this intervention, students learned to use the organizational skills form (self-monitoring form) over three lessons, divided into eight instructional steps: (1) organizing a notebook, (2) completing the demographic data and overview of the organizational skills form, (3) beginning to use the organizational skills form, (4) listing tests and assignments, (5) noting procedural exceptions, (6) recording assignments turned in, (7) tracking grades from assignments, and (8) counting completed items (Anderson et

al., 2008). Students in this study learned to use the organizational skills form which enabled them to organize their materials and track assignments, but they needed more than instruction in self-monitoring and form completion to improve their academic performance.

**Goal Setting Intervention.** Students are not usually taught to set short-term and long-term goals that guide them while doing homework, while studying and while taking a test. Many children with executive functions deficits may begin a task impulsively, often not knowing how to proceed to the next step and turning in an end product that is disorganized (Meltzer, Pollica, & Barzillai, 2007). A cyclical relationship exists between a student's ability to set personal goals, guide behaviors, and enhance motivation (Schunk, 1995). Goal setting requires students to set goals, and to have the means to monitor their progress towards their goals (Johnson & Reed, 2011). Students need to understand the reasons why it is important to set goals in order to help students become independent learners (Meltzer, 2010). Students with ADHD may not be aware of goals associated with academic tasks or they may not remember goals (Barkely, 2006). Furthermore, students with ADHD may be more easily prone toward maladaptive goals, therefore inhibiting their performance (Barkely, 2006). By teaching students the importance of setting goals, and then monitoring their progress, they learn to self-monitor their school work and behavior.

**Note Taking Intervention.** Students with learning disabilities benefit from guided notes which involve teaching students how to use structured or cued note-taking paper during lectures. (Hamilton, Seibert, Gardner, & Talbert-Johnson, 2000). Boyle's (2010) studies have illustrated the fact that once students were taught to use a note-taking

technique, notes improved, as well as their comprehension. This improvement is often reflective of a reduced load on working memory, particularly verbal working memory, as well as increased attention directed toward the important aspects of the lecture (Berninger, Neilsen, et al., 2008). Teachers can assist in this process by presenting critical information in a clearly organized manner, cueing students' attention to the important aspects of the lecture and slowing down the pace of the lecture (Boyle, 2010). These techniques are especially important to utilize in the middle school level when students are expected to take notes in their academic classes. It may also alleviate any anxiety that students may have about being able to keep up with their peers, and about having sufficient information for upcoming assignments, tests and/or projects.

**Summary of Literature Review**

Although there are various definitions and models of executive functions have evolved over time, it is commonly believed that executive function is a psychological construct that can be best described as a number of separate yet interrelated control processes that are activated during novel activities in which new solutions are needed or when initial learning takes place (Anderson, 2002). The challenges of middle school require good executive function capacities to manage and produce successful academic and social outcomes. There are greater demands for selective attention, extended mental effort, higher-order problem solving, increased control over information processing, and need for coordinating multiple processes simultaneously during academic tasks. Children with executive dysfunctions may present with academic, social or behavioral difficulties. The ultimate goal of intervention is to improve functioning in daily activities both in school and in home environments. The majority of the published research on executive

functions is with adults. As a result, further research is needed to understand how executive functions manifests in school and in children of different ages. The current study examined not only grades from the first marking period to the second marking period but also changes in the use of executive functions for a sample of eighth grade students with IEPs who are enrolled in an academic support program.

**Overview of the Program**

The efficacy of the Executive Functions (EF) Program was evaluated by Leon (2008) in four Chicago-area schools. Rush NeuroBehavioral Center contracted the study to establish an evidence-based program for executive function skills. Students from fourth through eighth grades were included in a five-year study. The poverty level of the schools ranged from between 85 percent to 99 percent, as defined by participation in the free and reduced lunch program at school. The study focused on adherence to the materials and time-management aspects of the program. Program adherence data were correlated with grades earned in the subject areas of reading and math, as well performances on standardized reading tests. Students in this study during the 2006-2007 school year demonstrated a high degree of adherence to the materials management portion of the program. Additionally, students who performed well in the EF Curriculum had a higher rate of homework completion and earned higher grades as measured in reading and math. Furthermore, students who demonstrated mastery of organizing, as measured by entering upcoming homework assignments as well as tests/quizzes and long-term projects in their planners, acheived15 to 25 percent higher test performances on standardized reading tests in grades six through eight, compared with students who did not consistently put the EF curriculum into practice. The results were achieved after

statistically controlling for demographic variables and standardized tests scores from the prior year. Students, parents and faculty expressed satisfaction with the EF curriculum (Leon, 2008).

The Executive Functions Program was examined for student adherence in two schools in Chicago (Gattuso, et al., 2007). Sixty-seven students from third to eight grades were randomly selected to participate in the study. School A was in the third implementation year at the time of the study but School B had just begun implementing the curriculum at the time of the study. In addition, School A was located in a high socioeconomic status neighborhood and School B was located in a low socioeconomic status. Students were selected to participate in an observational and interview tool developed specifically for the study, the Loyola Executive Function Team Observational Coding System. Results indicated that 77 percent of School A's students demonstrated knowledge mastery, compared with only 52 percent of School B's students. (Gattuso, et al., 2007).

The topics in the Executive Functions Skill-Building Program are designed as a sequential system and consisting of four units. The first unit, the Foundational Units, is designed to enable students to have the organizational structures in place to start the school year. The topics include: Classroom Structures and Learning Environment, Managing Materials, and Managing Time. The Classroom Structures and Learning Environment include suggestions for designing the physical environment of a classroom, handling the logistics in assigning and collecting homework, managing time and transitions and modeling organizational strategies for students. The Materials

Management is designed to help students better manage their materials, presents options for classroom or individual long-term storage of important papers, and techniques for tracking academic performance. The Time Management and Planning unit teaches students to manage time by using personal planners to record homework and important activities, prioritizing assignments, and breaking down long-term tasks. The second unit group, Study Strategies and Academic Support, represents higher order topics and includes the following topics: Following Directions, Memory Techniques, Note-Taking/Organizing Information, Test Preparation and Reflection. The Study Strategies unit includes suggestions to improve students' abilities to follow oral and written directions; take accurate notes and organize information; apply memory techniques; and effectively prepare for, take and reflect on tests. This unit incorporates the foundational academic skills of reading, writing and math. The third and final unit group, Personal Growth, addresses the executive function area of self-awareness and includes the following topics: Learning Strengths, Goal Setting and Decision Making. The Goal Setting unit emphasizes the importance of goal setting in a variety of contexts and describes characteristics of successful goals. Students are taught how to break down long-term goals into action steps in this unit. The Decision Making/Problem Solving units display the steps students should take when making important and difficult decisions. Finally, the Learning Strengths unit assists students in identifying, understanding and optimizing their learning strengths in the context of different tasks and academic content areas. The program is designed to be taught in varying order based on the specific needs of the individual classroom, grade level and school. (Bozeday, 2011)

Each unit in the curriculum notebook includes self-assessment tools. The self-assessment tools are designed to determine if a student is already using any of the skills presented in the unit and to monitor progress. The self-assessment can be completed in less than ten minutes. Teachers can use self-assessment to gather baseline data before beginning a unit or students can use assessments to reflect on what skills they already possess and what skills might be beneficial for them to learn.

**Research Question and Hypothesis**

This study will address the following research questions:

Question 1: Do teacher ratings on the Writing section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions with writing tasks for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 2: Do teacher ratings on the Reading section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions with reading tasks for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 3: Do teacher ratings on the Math section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions with math tasks for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 4: Do teacher ratings on the Independent Seat Work section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive

functions when working independently in class for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 5: Do teacher ratings on the Organization of Materials section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions to organize materials for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 6: Do teacher ratings on the Long Term Project Completion section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions to complete long term projects for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 7: Do teacher ratings on the Remembering Assignments section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions to remember assignments for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 8: Do teacher ratings on the Problem-Solving section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions when solving problems for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 9: Do teacher ratings on the Self Control section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions to improve self-control for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 10: Do students' grades in academic support class improve from first marking period to second marking period for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 11: Do students' grades in math improve from first marking period to second marking period for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 12: Do students' grades in language arts improve from first marking period to second marking period for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 13: Do students' grades in social studies improve from first marking period to second marking period for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

Question 14: Do students' grades in science improve from first marking period to second marking period for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?

It is hypothesized that teaching ratings on the Executive Functions (EF) Rating Scale will reflect an increase in the use of executive functions for a sample of students of eighth grade students with IEPs, who are enrolled in an academic support program. Additionally, it is hypothesized that students will maintain their grades from first marking period to the second marking period.

# Chapter 3

# Methods

## Overview of Research Design

Participants of this study included twenty-six students in the eighth grade from a suburban public school setting in New Jersey who were classified and had an Individualized Education Plan. The eighth grade curriculum was derived from the New Jersey core curriculum content standards. The language arts curriculum utilized in the district was based on Readers and Writers Workshop model. The math curriculum, Connected Math, was newly implemented during the time of the study. The math curriculum covered the following topics: data analysis, integers, equations, powers and exponents, fractions, decimals, and percents, ratios, rates, and proportions, probability, linear equations, inequalities and functions, linear functions and graphing, and geometry. The social studies curriculum consisted of an overview of American history with a focus on pivotal events and decisions that influenced the development of democracy in the United States. The science curriculum covered electric circuitry and its uses, structure and behavior of matter and energy.

All participants were enrolled in an academic support class for forty five minutes every day for the entire school year. Students were recommended for the academic support class in place of a foreign language class. There were three academic support periods taught by three special education teachers. Special education teacher A was the language arts teacher for students in the resource room and also the in-class support

language arts teacher. Special education teacher B was the mathematics teacher for students in the resource room and also the in-class support teacher for mathematics. Special education teacher C was the in-class support teacher for social studies and science. Each class had a teaching assistant.

Through the use of the Rush NeuroBehavioral Center's Executive Functions Skill-Building Program titled *A blueprint for success: Building an executive functions foundation for middle school students* twenty-six students in the eighth grade were taught explicitly how to improve their executive functions in areas such as planning, organization, study strategies, self-monitoring, goal setting, time management and decision making (Bozeday et al., 2011). Special education teachers implemented the Executive Functions (EF) Program (Bozeday et al., 2011,) beginning in November 2011. The funding for the program was obtained by a grant from the Regional Chamber of Commerce Education Foundation. The grant was written by child study team members which consists of a school psychologist, learning disabilities consultant and social worker. A mid-year and final report was submitted to the Regional Chamber of Commerce Education Foundation. The program consisted of a teacher curriculum notebook and student guides. Each unit consisted of a two-page overview, assessment tools, student resources, teacher resources and lesson plans. The comprehensive scope and sequence allows teachers to help students build on previously taught skills ((Bozeday et al., 2011). The EF curriculum includes eight sections including: overview, classroom structures & learning environment, materials management, time management and planning, study strategies, goal setting, decision making and problem solving, and learning strengths. The entire curriculum was not covered at the time of data collection.

On Mondays, a topic from the EF curriculum was introduced to the students. Students completed self-assessments on their own. The EF student guides were checked on Fridays by the teaching assistant for credit towards their academic support grades.

Each academic support class began with reviewing assignments for the day, week and month. Special education teachers collaborated with general education teachers to review students' progress and concerns. The special education teachers assisted and taught students how to prioritize their assignments, review for exams and quizzes, organize their materials, and reviewed content area. Students were supported in completing class work assigned in their academic classes. Topics, assignments, and projects covered in language arts, math, science and social studies were reviewed in academic support. Special education teachers assisted students to break down long-term projects, reminded students about incomplete assignments and reminded students to stay after school for extra help especially before exams and quizzes. Special education teachers and classroom assistants reviewed students' homework agendas for accuracy and reviewed the materials needed to be packed to complete assignments at home. Grades were posted on an internet-based program for students and parents to review on a regular basis. Report cards and progress reports were distributed four times during the school year.

**Measures and Procedures**

The current study made use of archival data collected from a suburban public school setting in New Jersey. Special education teachers completed the survey entitled, "Executive Functions Rating Scale," three times in total. The rating scale was created by

George McCloskey, faculty member at the Philadelphia College of Osteopathic Medicine (PCOM) and this researcher in May 2011. The Executive Functions Rating Scale included 44 items in the areas of Writing, Reading, Math, Independent Seat Work, Organization of Materials, Long-term Projects, Remembering, Problem Solving and Self-control. Responses to the rating scale included 4-point Likert Scale options ranging from 1-Never or Rarely a problem , 2- Sometimes a problem, 3- Often a problem, and 4-Always a problem. Confidentiality was assured by removing identifying information, including name and date of birth. Descriptive data included grades, classification, and scores on rating scales. Information was collected using the Executive Functions Rating Scale, these were secured in locked file cabinet at all times. It was completed by three special education teachers that taught language arts, math and the in-class support teacher for science class and social studies class. Baseline data using the Executive Functions Rating Scale were collected in June 1, 2011. The school psychologist and learning disabilities consultant met with special education teachers in the beginning of the school year to review findings from an Executive Functions Rating Scale completed by seventh grade special education teachers to create goals for each student. The Executive Functions Rating Scale was completed again on November 7, 2011 and on February 9, 2012. Report cards were distributed on November 17, 2011 and on February 1, 2012. Written approval and authorization to utilize the data set was obtained from the building principal.

## Analyses

The findings from the rating scales, grades, classification, IEP goals were combined into a Microsoft Excel spreadsheet, and then exported into the Predictive Analytics Software (PASW – 18.0). To provide answers to specific research questions, descriptive and inferential statistics were calculated PASW – 18.0. The study utilized repeated measures analyses of variance (ANOVA) to compare pre and post instruction data.

# Chapter 4

# Results

## Descriptive Statistics

Analyses were based on data gathered from a total of twenty-six eighth grade students. Of these students, 19 were males (73.1%) and 7 were females (26.9%) in the eighth-grade. Of the twenty-six students, 14 (53.8%) were classified under the category of a specific learning disability; 9 (34.6%) were classified under the category of other health impairment; 2 (7.7%) were classified under the category communication impairment and one (3.8%) was classified under the category autism. All 26 students had study skills goals in their IEPs and were enrolled in an academic support class. Twelve students (46.2%) had reading and writing goals and received special education services in a resource room setting for language arts; 11 (42.3%) had math goals and received special education services in a resource room setting for math. Finally, 9 (34.6%) had speech and language goals in their IEPs and received speech and language therapy.

Means and standard deviations of Executive Functions Rating Scale Subareas are reported in Table 4 and means and standard deviations for first and second marking periods are reported in Table 5.

Table 1

*Gender of Participants*

| Gender | n | % |
|---|---|---|
| Male | 19 | 73 |
| Female | 7 | 27 |
| Total | 26 | 100 |

Table 2

*Classification for Participants*

| Classification | n | % |
|---|---|---|
| Specific Learning Disability | 14 | 53.8 |
| Other Health Impaired | 9 | 34.6 |
| Communication Impaired | 2 | 7.7 |
| Autism | 1 | 3.8 |

Table 3

*Number of Participants with IEP Goals in Specific Areas*

| IEP Goals | n | % |
|---|---|---|
| Reading Goals | 12 | 46.2 |
| Writing Goals | 12 | 46.2 |
| Math Goals | 11 | 42.3 |
| Speech & Language Goals | 9 | 34.6 |
| Study Skills Goals | 26 | 100 |

Table 4

*Means and Standard Deviations of the EF Rating Scale Subareas*

| Section | 1 | 2 | 3 |
|---|---|---|---|
| | Mean (S.D.) | Mean (S.D.) | Mean (S.D.) |
| Writing | 11.65 (3.82) | 10.58 (3.99) | 11.81 (4.45) |
| Reading | 6.38 (1.84) | 6.23 (2.58) | 5.62 (2.23) |
| Math | 6.81 (2.04) | 7.04 (1.87) | 8.12 (2.03) |
| Independent Seat Work | 12.00 (3.91) | 11.69 (5.25) | 12.69 (4.55) |
| Organization of Materials | 8.38 (3.99) | 7.85 (4.30) | 8.27 (3.87) |
| Long-term Projects | 12.88 (4.31) | 12.46 (4.77) | 13.96 (4.66) |
| Remembering | 10.00 (3.16) | 9.81 (4.04) | 10.31 (3.88) |
| Problem Solving | 9.85 (3.23) | 9.96 (3.76) | 11.58 (3.83) |
| Self-Control | 10.77 (4.30) | 9.62 (4.58) | 11.19 (7.78) |

Table 5

*Means and Standard Deviations of Student Grades for First Marking Period and Second Marking Period*

| Class | First MP Mean (S.D.) | Second MP Mean (S.D.) |
|---|---|---|
| Academic Support | 92.31 (7.17) | 89.65 (6.00) |
| Math | 71.46 (9.35) | 74.15 (5.84) |
| Language Arts | 77.85 (4.37) | 76.65 (7.21) |
| Social Studies | 88.12 (5.28) | 83.46 (5.71) |
| Science | 85.96 (5.98) | 83.15 (6.75) |

**Statistical Analyses**

This study was conducted using archival data consisting of teacher ratings with an Executive Functions Rating Scale, report card grades, Individualized Education Plan (IEP) goals, and classification for Special Education and Related Services. Statistical analyses were conducted using an ANOVA with repeated measures. The .01 level ($\alpha = .01$) was used to determine statistical significance.

*Question 1: Do teacher ratings on the Writing section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions with writing tasks*

*for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

A repeated measures analysis of variance (ANOVA) comparing teacher ratings on the writing section before, during and after program implementation revealed no statistically significant difference( $F$ (2, 50) = 2.499, $p$ = .092).

*Question 2: Do teacher ratings on the Reading section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions with reading tasks for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated, $\chi 2$ (2) = 11.39, $p < .05$, and, therefore, a Greenhouse-Geisser correction was used. A repeated measures ANOVA comparing teacher ratings on the reading section before, during and after program implementation revealed no statistically significant difference ($F$ (1.5, 36.3) = 2.124, $p$ = 0.146).

*Question 3: Do teacher ratings on the Math section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions with math tasks for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

A repeated measures ANOVA comparing teacher ratings on the math section before, during and after program implementation revealed a statistically significant difference, ($F$ (2, 50) = 9.314, $p < .001$). The group mean rating increased from a pre-program value of 6.81 (SD = 2.04) to a post-program value of 8.12 (SD = 2.02). This

score difference reflects a negative change rather than a positive one because higher scores indicate greater difficulty with the use of executive functions when performing math tasks.

*Question 4: Do teacher ratings on the Independent Seat Work section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions when working independently in class for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated, $\chi 2\ (2) = 6.15$, $p < .05$, and, therefore, a Greenhouse-Geisser correction was used. A repeated measures ANOVA comparing teacher ratings of the use of executive functions during independent seat work before, during and after program implementation revealed no statistically significant differences ($F\ (1.6, 40.7) = .716$, $p = .468$).

*Question 5: Do teacher ratings on the Organization of Materials section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions to organize materials for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated, $\chi 2\ (2) = 15.47$, $p < .05$, and, therefore, a Greenhouse-Geisser correction was used. A repeated measures ANOVA comparing teacher ratings of the use of executive functions to organize materials during class before, during and after program implementation revealed no statistically significant differences ($F\ (1.4, 33.9) = .291$, $p = .663$).

*Question 6: Do teacher ratings on the Long Term Project Completion section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions to complete long term projects for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

A repeated measures ANOVA comparing teacher ratings of the use of executive functions to complete long-term projects before, during and after program implementation revealed no statistically significant difference ($F$ (2, 50) = 2.413, $p$ = .100).

*Question 7: Do teacher ratings on the Remembering Assignments section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions to remember assignments for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated, $\chi 2$ (2) = 7.80, $p < .05$, and, therefore, a Greenhouse-Geisser correction was used. A repeated measures ANOVA comparing teacher ratings of the use of executive functions to remember assignments before, during and after program implementation revealed no statistically significant difference ($F$ (1.56, 39.14) = .361, $p$ = .648).

*Question 8: Do teacher ratings on the Problem-Solving section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions when solving problems for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

A repeated measures ANOVA comparing teacher ratings of the use of executive functions to improve problem solving skills before, during and after program

implementation revealed no statistically significant difference ($F$ (2, 50) = 24.34, $p$ = .713).

*Question 9: Do teacher ratings on the Self-Control section of the Executive Functions (EF) Rating Scale reflect an increase in the use of executive functions to improve self-control for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated, $\chi 2$ (2) = 7.12, $p < .05$, and, therefore, a Greenhouse-Geisser correction was used. A repeated measures ANOVA comparing teacher ratings of the use of executive functions to improve self-control before, during and after program implementation revealed no statistically significant difference ($F$ (1.59, 39.79) = 3.66, $p$ = .044).

*Question 10: Do students' grades in academic support class improve from first marking period to second marking period for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

A repeated measures ANOVA comparing first marking period grades to second marking period grades in academic support revealed no statistically significant difference ($F$ (1, 25) = 6.77, $p$ = .015).

*Question 11: Do students' grades in math improve from first marking period to second marking period for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

A repeated measures ANOVA comparing first marking period grades to second marking period grades in math revealed no statistically significant difference ($F$ (1, 25) = 6.23, $p$ = .019).

*Question 12: Do students' grades in language arts improve from first marking period to second marking period for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

A repeated measures ANOVA comparing first marking period grades to second marking period grades in language arts revealed no statistically significant difference ($F$ (1, 25) = .883, $p$ = .356).

*Question 13: Do students' grades in social studies improve from first marking period to second marking period for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

A repeated measures ANOVA comparing first marking period grades to second marking period grades in social studies revealed a statistically significant difference ($F$ (1, 25) = 40.70, $p$ < .001). The change, however, was in the opposite of the hypothesized change because grades in social studies decreased from first marking period (M = 88.12, SD = 5.27) to second marking period (M = 83.46, SD = 5.70).

*Question 14: Do students' grades in science improve from first marking period to second marking period for a sample of eighth grade students with IEPs, who were enrolled in an academic support program?*

A repeated measures ANOVA comparing first marking period grades to second marking period grades in language arts revealed no statistically significant difference ($F$ (1, 25) = 7.00, $p$ = .014).

# Chapter 5

## Discussion

Due to the demands of middle school that require self-directed and goal-oriented behavior, the use of executive functions is critical in the development of academic competence. Improving students' capacities for use of executive functions at early ages may have increasing benefits over time and may reduce the number of diagnoses of executive functions disorders (Diamond et al., 2007). Early attention to developing efficient executive functions can be very helpful, and as a rule, direct instruction, frequent reassurance and explicit feedback are strongly recommended (Meltzer, 2007). Targeted support for children with executive dysfunction, whether through specific remediation of executive deficits or through increased support within the classroom setting, has the potential to significantly improve children's academic and social functioning (Jacobson, Williford, & Pianta, 2011). The demands of completing schoolwork independently, long term projects, more complex routines and academic work at the middle school level can often trigger signs that there are difficulties in executive functions. The middle school curriculum emphasizes the ability to complete long-term projects, manage time, organize materials, remember information, study and prepare for exams and quizzes. Strategies should be linked directly to the curriculum, taught systematically and explicitly, and supported through the use of scaffolding and collaborative practice (Meltzer, Pollica, & Barzillai, 2007). The purpose of the research study was to examine changes in executive functions in eighth-grade students who were enrolled in an academic support class using

the Executive Functions Rating Scale and to examine changes in their grades from the first marking period to the second marking period.

Results from this study did not find a significant difference on the Writing, Reading, Independent Seat Work, Organization of Materials, Long-Term Projects, Remembering, Problem Solving and Self-Control sections of the Executive Functions Rating Scale for a sample of eighth grade students with IEPs who were enrolled in an academic support program. Although not finding significant difference on EF ratings obtained before, during and immediately after program implementation, all of the students' mean grades were all within the passing range. Academic support grades remained consistent from the first marking period (M = 92.31) to the second marking period (M = 89.65). Grades in language arts remained consistent from the first marking period (M = 77.85) to the second marking period (M = 76.65). In the area of math, teacher EF rating decreases were statistically significant, indicating that students were having more difficulty with the use of executive functions related to math tasks as the year progressed. This was the first year of implementation of the Connected Math language based curriculum in eighth grade. Although EF ratings did not improve, math grades increased from the first marking period (M = 71.46) to the second marking period (M = 74.15). Conversely, grades in social studies decreased from the first marking period (M = 88.12) to the second marking period (M = 83.46). Although grade point decreases were statistically significant in social studies, grades remained within the passing range. Grades in science remained consistent from the first marking period (M = 85.96) to the second marking period (M = 83.15). Overall, mean grades were maintained from the first marking period to the second marking period in all classes.

An examination of individual student progress based on teacher ratings on the Executive Functions Rating Scale yielded greatest improvement on the Reading and Organization sections during and after program implementation. Nine students showed improvement on the Reading section and eight students showed improvement on the Organization section for the use of executive functions to organize materials during class during and after program implementation. Five students demonstrated improvement, based on teacher ratings on the Remembering section of the Executive Functions Rating Scale. Four students showed improvement based on teacher ratings on the Independent Seat Work, Problem Solving and Long-term Projects sections of the Executive Functions Rating Scale. Last, three students showed improvement in the use of executive functions on the Self-Control section of the Executive Functions Rating Scale, based on teacher ratings.

During the 2010-2011 school year, fifteen students were enrolled in the academic support class taught by two special education teachers. The Executive Functions Skill Building Program was not utilized during this school year. An examination of students' grades from the first marking period to the second marking period revealed that two students failed math during the second marking period. Two students failed language arts and one student failed social studies during the second marking period of the 2010-2011 school year. During the 2011-2012 school year, when the Executive Functions Skill Building Program was utilized, of the twenty-six students, only one failed math, and did so for both the first and second marking periods.

This is the first year of implementation of the Executive Functions Skill-Building Program in this school setting. Additionally, certain characteristics of the school setting may have affected the way in which teachers in school settings rate their students. Middle school teachers have multiple classes and interact with more children per day than do typical elementary school teachers. They may tend to rate individual children less thoroughly or knowledgably than do elementary school teachers. The specific behaviors or cognitive states measured by the items of the EF rating scale may have been difficult for special education teachers to observe during the school day. Teacher A taught language arts and academic support, teacher B taught math and academic support and teacher C taught academic support; she was also the in-class support teacher in social studies and science. Progress monitoring was conducted for a total of six months and included baseline data collected in June 2011. As the school year progressed, the academic demands placed on students increased greatly, relative to preparing for tests and quizzes, projects and daily homework assignments and retention of previously taught materials increased greatly. Students who were enrolled in sports, after school clubs and other extracurricular activities had additional demands on their capacities for managing their time efficiently. Although the findings from teacher ratings were not significant, students were able to maintain mean grades within the passing range.

**Limitations of Study**

There are several limitations related to the present study. First, the study focused on eighth-grade students; therefore, the results may not be generalizable to younger or older students. The sample was a mixed group of students with different classifications

including specific learning disability, autism, communication impairment and other health impairment. The study was conducted in one suburban school setting in New Jersey with a small sample size and, as a result, impacts the generalizability of the study. Additionally, the study did not utilize a control group for comparison. Teachers did not have formal training in the implementation of the EF curriculum. Furthermore, the entire EF curriculum was not covered at the time of data collection. The rating scales were completed by three different special education teachers during the course of the study. Assessments to measure executive functions directly were not utilized in this study.

Demographic information for the teachers was not available for the study. Variables such as age, teaching experience, and years of training may influence teachers' judgments regarding observation of executive functions in students who receive special education and related services. Furthermore, the use of rating scales in this study does allow for open ended responses. The scale is focused solely on problem behavior descriptions; therefore, it was not possible to measure those students did who well in regard to executive functions. It would be beneficial to supplement findings with data from classroom observations and structured interviews with teachers and students. The ultimate goal of the intervention plan is to help the student internalize control and engage in self-regulation; that the intervention plan will include a transition stage during which the student will be taught ways to improve self-regulation. Students should be guided through a process of moving from external control of behavior to internal control of perceptions, feelings, thoughts and action (McCloskey et al., 2007). A transition stage was not incorporated in this study.

## Future Directions

Researcher have paid insufficient attention to executive functions interventions among the adolescent population. Future research using the Executive Functions Skill-Building Program should include direct assessments of executive functions and include ratings scales completed by parents and subjects when evaluating interventions. Researchers might want to consider creating rating scales with questions stated in a positive framework in order to measure students' abilities and to measure growth accordingly. Additionally, a mental health assessment might be valuable to screen for students presenting with anxiety, depression and for those with difficulties coping with stress and academic demands. Educators using the Executive Functions Skill Building Program might want to consider utilizing the self-assessment tools provided in each curriculum to monitor progress. Educators might want to consider using the self-assessment to gather baseline data before beginning a unit. Students can use the self-assessment to reflect on those skills that they already possesses and those skills that might be beneficial for them to learn when using the Executive Functions Skill Building Program.

Future research should include longitudinal studies on changes in executive functions and follow students into the high school setting to examine treatment efficacy. Results from short term studies are not immediately apparent but may be evident at some point in the future. Brain imaging might provide a means to determine whether or not an intervention is effective during the course, even before behavioral changes can be

observed or manifested. Future research needs to be conducted on effective interventions for executive functions and the use of interventions with different age ranges.

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Appendix

**Executive Functions Rating Scale**

Student's Name: _____ Gender: M / F Birth date: ___/____/_____

Your name: _____ Relationship to Student: _____

Have known student for ____ months. Today's Date: ___/___/_____

How well do you know this student? [ ] Not well [ ] Moderately well [ ] Very well

**For each statement below, think about your student over the past six months and provide a rating that best describes how often the statement has been a problem for your student during that time.**

| | | | |
|---|---|---|---|
| 1 | N/R | if the behavior is | Never of Rarely a problem |
| 2 | S | if the behavior is | Sometimes a problem |
| 3 | O | if the behavior is | Often a problem |
| 4 | A | if the behavior is | Always a problem |

| **During writing tasks:** | N/R | S | O | A |
|---|---|---|---|---|
| 1. Demonstrates poor motor control of pen/pencil, keyboard, etc. | 1 | 2 | 3 | 4 |
| 2. Demonstrates poor planning for how written information will fit on a page. | 1 | 2 | 3 | 4 |
| 3. Writing is a struggle and not automatic. | 1 | 2 | 3 | 4 |
| 4. Has difficulties with organizing content of written material. | 1 | 2 | 3 | 4 |
| 5. Has difficulties with generating and using ideas when writing. | 1 | 2 | 3 | 4 |
| 6. Has difficulties holding and manipulating thoughts, and/or retrieving ideas, when writing. | 1 | 2 | 3 | 4 |

| **During reading tasks:** | N/R | S | O | A |
|---|---|---|---|---|
| 7. Has difficulties with recalling and using learned decoding strategies. | 1 | 2 | 3 | 4 |
| 8. Has difficulties with reading words fluently (maintaining adequate speed when reading). | 1 | 2 | 3 | 4 |
| 9. Have difficulties understanding and using information read in a sentence, passage, or longer article. | 1 | 2 | 3 | 4 |

| **During math tasks:** | N/R | S | O | A |
|---|---|---|---|---|
| 10. Has difficulties with monitoring progress and self-correcting errors when doing math calculations. | 1 | 2 | 3 | 4 |
| 11. Has difficulties with holding and manipulating information, organizing a strategy, and/or retrieving steps accurately when doing math calculations. | 1 | 2 | 3 | 4 |
| 12. Has difficulties organizing, storing, retrieving, and/or executing steps when learning and/or applying calculation routines. | 1 | 2 | 3 | 4 |

| **Independent Seat Work** | N/R | S | O | A |
|---|---|---|---|---|
| 13. Difficulty understanding task directions | 1 | 2 | 3 | 4 |
| 14. Difficulty getting started on his/her own | 1 | 2 | 3 | 4 |
| 15. Difficulty asking for help when it is needed | 1 | 2 | 3 | 4 |
| 16. Struggles to check work and makes careless mistakes | 1 | 2 | 3 | 4 |
| 17. Struggles to finish work on time | 1 | 2 | 3 | 4 |
| 18. Difficulty remembering to turn hand in work | 1 | 2 | 3 | 4 |

| **Organization of Materials** | N/R | S | O | A |
|---|---|---|---|---|
| 19. Difficulty keeping notebooks, binders and papers organized | 1 | 2 | 3 | 4 |
| 20. Struggles to keep belonging neat and in appropriate locations (e.g. gym clothes) | 1 | 2 | 3 | 4 |
| 21. Difficulty keeping track of books, papers, pencils, calculator etc. | 1 | 2 | 3 | 4 |
| 22. Difficulty keeping backpack and locker organized | 1 | 2 | 3 | 4 |

| **Long-term Projects** | N/R | S | O | A |
|---|---|---|---|---|
| 23. Difficulty deciding on a topic | 1 | 2 | 3 | 4 |
| 24. Struggles to break the assignment into smaller parts | 1 | 2 | 3 | 4 |
| 25. Struggles to develop a timeline to complete projects | 1 | 2 | 3 | 4 |
| 26. Difficulty following a timeline for a project | 1 | 2 | 3 | 4 |
| 27. Struggles to complete project by the deadline | 1 | 2 | 3 | 4 |
| 28. Fails to proofread or check project to catch mistakes | 1 | 2 | 3 | 4 |

| **Remembering** | N/R | S | O | A |
|---|---|---|---|---|
| 29. Forgets to write down assignments | 1 | 2 | 3 | 4 |
| 30. Forgets to bring home appropriate materials (e.g. books, agenda, notices) | 1 | 2 | 3 | 4 |
| 31. Forgets to bring school appropriate materials | 1 | 2 | 3 | 4 |
| 32. Loses things in the classroom or other places in the school | 1 | 2 | 3 | 4 |
| 33. Struggles to remember instructional sequences after instruction | 1 | 2 | 3 | 4 |

| **Problem Solving** | N/R | S | O | A |
|---|---|---|---|---|
| 34. Does not recognize that he or she has a problem | 1 | 2 | 3 | 4 |
| 35. Struggles to think flexibly about the problems (i.e., not get stuck by one approach) | 1 | 2 | 3 | 4 |
| 36. Difficulty problem solving on his or her own before getting help | 1 | 2 | 3 | 4 |
| 37. Struggles to assess appropriate resource to help him or her to solve the problem | 1 | 2 | 3 | 4 |
| 38. Difficulty evaluating his or her own performance to know whether the problem was solved successfully | 1 | 2 | 3 | 4 |

| **Self Control** | N/R | S | O | A |
|---|---|---|---|---|
| 39. Becomes easily upset | 1 | 2 | 3 | 4 |
| 40. Throws temper tantrums | 1 | 2 | 3 | 4 |
| 41. Acts impulsively, either verbally or physically | 1 | 2 | 3 | 4 |
| 42. Interrupts others | 1 | 2 | 3 | 4 |
| 43. Difficulty waiting his or her turn | 1 | 2 | 3 | 4 |
| 44. Difficulty sustaining attention during class lessons | 1 | 2 | 3 | 4 |